Project: **1374**
Project title: **TIPPing points Explained by Climate Change (TIPPECC)**
Principal investigator: **Torsten Weber**
Report period: **2024-05-01 to 2026-04-30**

Project Overview

The TIPPECC project ("Tipping Points Explained by Climate Change") focuses on southern Africa and is funded through the BMBF SASSCAL 2.0 program (FKZ01LG2049B) for three years plus a cost-neutral one-year extension. In response to the SADC Grand Challenge, TIPPECC addresses climate change-induced tipping point risks in the region. At GERICS, we lead Work Package 1 (WP1), developing new high-resolution regional climate projections for southern Africa using the ROM (GERICS-AWI) model driven by the AWI-CM GCM from the CMIP6 simulations.

Performed simulations, summary of preliminary results

As part of the work package 1, GERICS is providing a high-resolution regional climate projection using an ESM from the CMIP6 ensemble as the driving model. The status of the simulations is listed in Table 1.
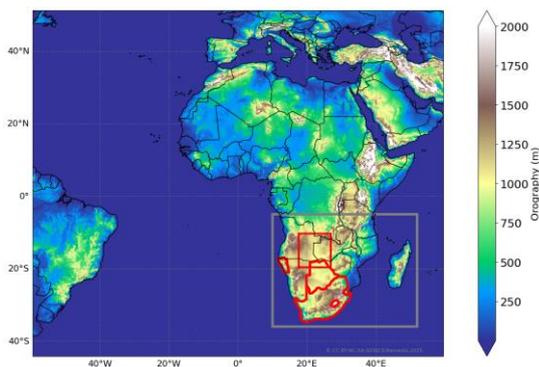

Fig. 1: Model domain (grey box) for the uncoupled simulation with REMO2020. It shows the TIPPECC region over southern Africa. The red outlines show the case study regions of Kunene and Upper Zambezi river basins in Namibia and the countries of Botswana and South Africa.

Table 1. Revised simulations at 0.11 x 0.11 deg.

Experiment ID	Description	Simulation years	Status
REMO_uncoupled_REAN	Uncoupled ROM driven by reanalysis	1981 to 2010 (30)	Cancelled
REMO_AWICM_HIST	Uncoupled ROM driven by AWI-CM	1951 to 2014 (64)	Done
ROM_AWICM_HIST	ROM driven by AWI-CM	1951 to 2014 (64)	Done
ROM_AWICM_SSP370	ROM driven by AWI-CM SSP370	2015 to 2100 (86)	Cancelled
REMO2020_REAN	ROM driven by ERA5	1990 to 2023 (34)	Done
REMO2020_ECE_HIST	ROM driven by EC-EARTH3	1970 to 2014 (45)	Done
REMO2020_ECE_SSP370	ROM driven by EC-EARTH3	2015 to 2100 (86)	Running

The planned simulations *REMO_uncoupled_REAN and ROM_AWICM_SSP370* could not be carried out due to insufficient storage space on Levante to prepare the forcing data. Therefore, it was decided to conduct a regional climate projection with the SSP370 scenario using the regional atmosphere-only model REMO2020 over southern Africa to provide regional climate change information for the project.

Initially, REMO2020 was driven by ERA5 reanalysis data *(REMO2020_REAN)* over southern Africa at a spatial resolution of 0.11 × 0.11° for the period 1990–2023 to assess the model's performance. This simulation has been completed. The analysis of the mean annual precipitation shows a slight overestimation along the coastal region of South Africa and an underestimation of precipitation in the interior of the continent and north of 20°S (Fig. 2). The historical simulation forced with EC-EARTH3 *(REMO2020_ECE_HIST)* is completed. Currently, the projection *(REMO2020_ECE_SSP370)* is being driven by the ESM EC-EARTH3 using the SSP370 scenario for the period 2014–2100. The projection is expected to be completed by the end of April.
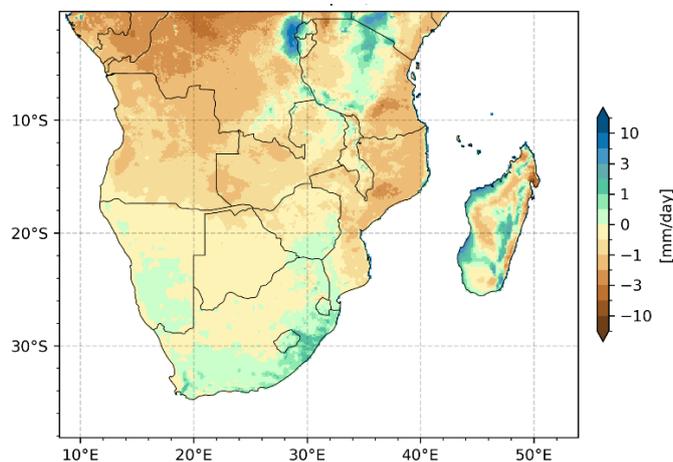

Fig. 2: Comparison of the mean annual precipitation simulated by REMO2020 minus CHIRPS at a spatial resolution of 0.11°x0.11 for the period 1990–2020.

Resources used at DKRZ

In the reporting period, the computing time granted was fully consumed and the remaining storage space on Levante will be used to postprocess the model output.